

## SECTION 5

### RELEASE RESPONSE

#### 5.1 General Discussion

The State UST regulations require owners and operators to take specific steps to respond to confirmed releases from USTs. These requirements are specified in Hawaii Administrative Rules Title 11 Department of Health Chapter 64 Underground Storage Tanks (HAR 11-281), Subchapter 7. Appendix 5-A contains a copy of HAR 11-281, Subchapter 7. The State UST regulations are quite specific in describing the types of actions that owners and operators must undertake in response to releases from their USTs. In particular, the State UST regulations specify actions in the following areas:

- Immediate response actions;
- Posting of signs;
- Initial abatement measures and site assessment;
- Initial site characterization;
- Free product recovery;
- Investigation of soil and groundwater contamination;
- Site cleanup criteria;
- Public notice of confirmed releases;
- Corrective action plans;
- Public participation for corrective action plan; and
- Financial responsibility demonstration.

In addition, the State UST regulations require owners and operators to submit reports on their release response activities to the DOH within specified time frames.

In an effort to clarify, streamline, and facilitate release responses in Hawaii, DOH has integrated reporting requirements of most of the State's UST release response requirements into two types of release response reports, "Initial Release Response Report" and longterm "Quarterly Release Response Reports." These reports and their required contents are described in Section 5.3.

The purpose of Section 5 is to provide detailed guidance on UST release responses in light of the State's adoption of HAR 11-281. In addition, there have been a number of changes in DOH policy regarding UST investigation and cleanup since the release of the August 1992 (First Edition) version of the TGM. These changes, which had been described in Policy Updates issued by DOH, are now either directly integrated or integrated by reference into this Second Edition of the TGM. The most significant change in DOH UST release response and cleanup policy since the release of the first edition TGM has been DOH's adoption of a tiered risk-based decision making process for evaluation of sites with contaminated soil and groundwater. This process, known as risk-based corrective action (RBCA - pronounced rebecca), is described in the DOH document titled *Risk-Based Corrective Action and Decision Making at Sites With Contaminated Soil and Groundwater, Volumes I and II* (hereafter referred to as DOH RBCA), dated December 1995 and revised in June 1996. The Second Edition of the TGM integrates text from parts of the DOH RBCA document that affect cleanup and decision making as part of the release response process. However, the DOH RBCA manual is a stand alone policy and technical document. If they have not already done so, owners, operators and consultants should request a copy from DOH and become familiar with its procedures and requirements in order to successfully utilize DOH RBCA. Only through a thorough review of **both** the Second Edition TGM and DOH RBCA documents will owners, operators and consultants have the knowledge necessary to appropriately respond to releases from their USTs in compliance with DOH requirements. A copy of the DOH RBCA document may be downloaded from the DOH Web Site at <http://www.state.hi.us/health/eh/shwb/ust/>.

Section 5 also provides a detailed discussion on the types of activities involved in a response to a UST release. Figure 5.1 presents a decision tree on the release response process. Finally, this section specifies reporting and recordkeeping requirements to demonstrate compliance. The reporting and recordkeeping requirements have been streamlined and modified to reflect a new DOH release response protocol to comply with the State UST regulations.

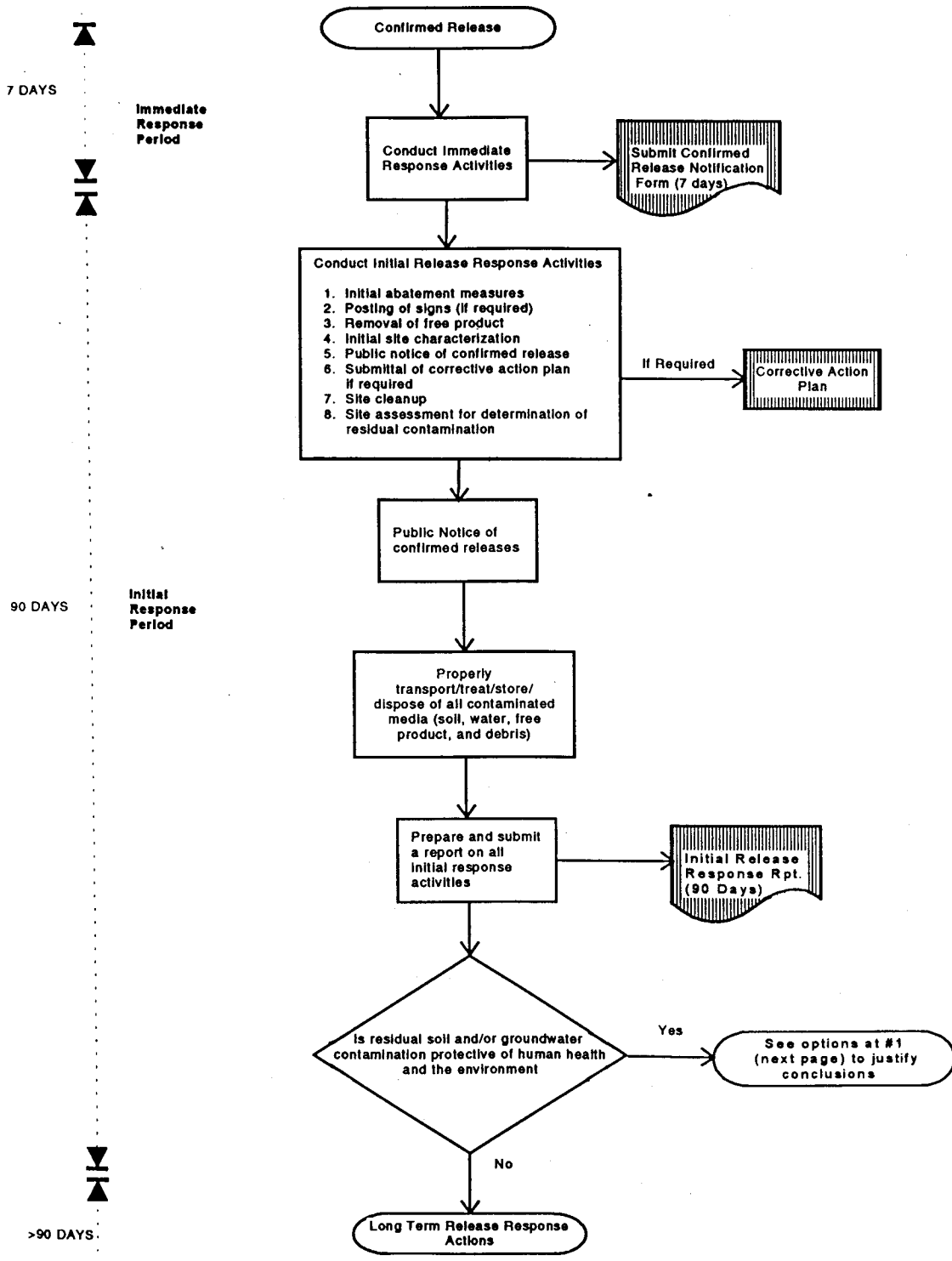


Figure 5.1 Decision Tree for Release Response

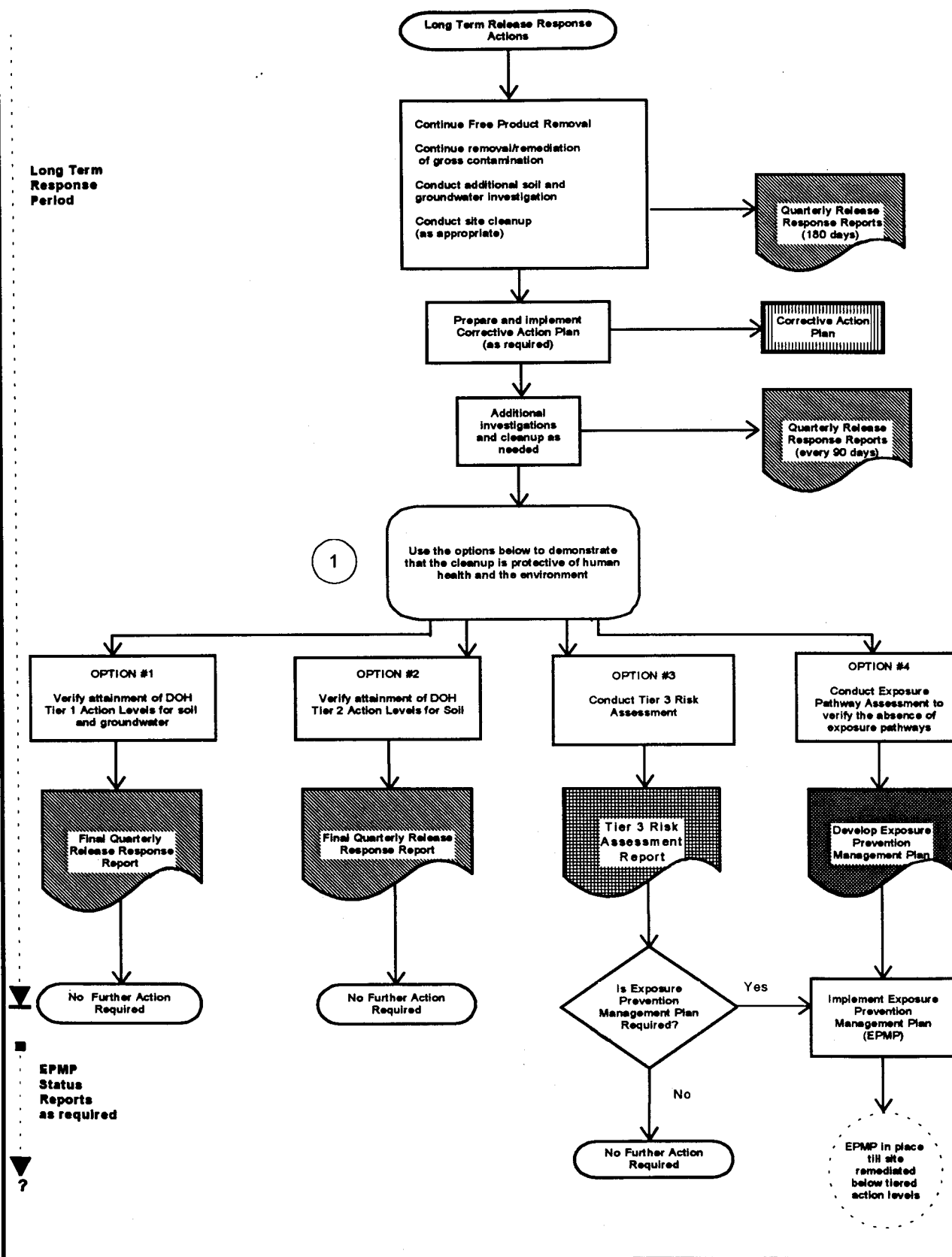


Figure 5.1 Decision Tree for Release Response (Continued)

## 5.2 Streamlined Approach to Release Response and Reporting

Section 5 is intended to provide a clear, streamlined, and practical approach to facilitate responses to releases and reports to DOH. In order to provide owners and operators with a clearer understanding of the release response protocol, DOH has facilitated the release response process by categorizing release response actions into three segments:

1. Immediate response actions
2. Initial release response actions
3. Long-term release response actions

In addition, DOH has attempted to "streamline" the State release response reporting requirements by consolidating the required reports into fewer, more comprehensive reports. The most prominent consolidation is the combination of "Initial Abatement Measures and Site Assessment," "Initial Site Characterization," "Free Product Removal," and "Investigation of Soil and Groundwater" (or as much of the investigation results as are available) into one single comprehensive Initial Release Response Report for submittal to DOH within 90 days of discovery of a release. DOH believes that streamlining the reporting requirements will facilitate the release response by enabling the owner and operator to respond more practicably and promptly to releases, especially to the smaller, more manageable ones.

DOH believes this approach to the release response reporting process are in the best interest of all parties and will encourage owners and operators and their consultants/contractors to quickly proceed with release response actions with minimal oversight by DOH. Owners and operators and their consultants/contractors should particularly note that unless specifically requested by DOH, release response work plans are not required to be submitted. Table 5.1 lists the types of report submittals that may be required when undertaking release response actions.

**Table 5.1 Reporting Requirements For UST Release Response**

REPORTING REQUIREMENTS FOR RELEASE RESPONSE (HAR 11-281, Subchapter 7)			
Report Description	How to Notify	When Report(s) Must be Submitted	Purpose of Report
Release Response Work Plan	Work Plan	Only when specifically requested by DOH	To provide DOH with detailed information on plans for undertaking any and all release response actions.
Confirmed Release Notification (CRN)	Phone	Within 24 hours after discovery of a release	To notify DOH of the UST release and response actions taken to date. Provides DOH with an opportunity to advise owners and operators on release response requirements.
	CRN Form	Within 7 days after discovery of a release	
Initial Release Response Report	Report	Within 90 days after discovery of a release	To inform DOH of all actions taken within the first 90 days in response to a UST release.
Quarterly Release Response Report	Report	Within 10 days after discovery of a release and every 90 days thereafter in cases where release response actions exceed 90 days	To inform DOH of additional actions taken beyond the first 90 days. The 4th Quarterly Report must contain a schedule for completion of cleanup.
Corrective Action Workplan (CAP)	Work Plan	Submit workplan within 30 days following its request by DOH	To demonstrate that remedial action will be safe and protective of human health and the environment.
Corrective Action Plan Quarterly Monitoring Report	Quarterly Release Response Report	CAP monitoring reports are required every 90 days	To demonstrate that CAP is operating and performing as anticipated and to describe the progress of cleanup. May be integrated into the Quarterly Release Response Report.

OPTIONS TO DEMONSTRATE PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT			
OPTION 1: COMPLIANCE WITH DOH'S TIER 1 ACTION LEVELS FOR SOIL AND GROUNDWATER			
Report Description	How to Notify	When Report Must be Submitted	Purpose of Report
Tier 1 evaluation of soil and groundwater	Initial or Quarterly Release Response Report	When residual contamination is less than DOH's Tier 1 action levels	To verify adequacy of site characterization and that concentrations of any contaminants remaining on site are below Tier 1 action levels
OPTION 2: DEVELOPMENT OF TIER 2 SOIL ACTION LEVELS			
Site specific Tier 2 evaluation of soil contamination	Initial or Quarterly Release Response Report	When residual soil contamination is less than site specific Tier 2 action levels	To verify adequacy of site characterization and that the concentration of any soil contaminants remaining on site are below Tier 2 action levels for soil
OPTION 3: DEVELOPMENT OF TIER 3 RISK ASSESSMENT*			
Risk Assessment	Initial or Quarterly Release Response Report	When alternative levels of risk can be demonstrated to be acceptable	To demonstrate through a formal and site specific risk assessment that residual contamination does not present an unacceptable risk to human health or the environment
OPTION 4: DEVELOPMENT OF EXPOSURE PREVENTION PLAN*			
Exposure Pathway Assessment	Report	Submit report as soon as possible upon completion	To establish that no current exposure pathways to human and non-human receptors exists
Exposure Prevention Management Plan	Report	Submit as soon as possible upon completion	To formalize all monitoring and response actions that will be taken to prevent exposure of human and non-human receptors to residual contaminants

\* Option 4 may require additional cleanup and reporting

The State UST regulations contain additional release response requirements to those Federal UST regulations found in 40 CFR Part 280. These additional requirements include posting of signs (if required by DOH, see HAR 11-281-73) and public notice of confirmed releases. It should be noted that not all of these new release response requirements may be applicable to a particular site. This second edition of the TGM incorporates these new requirements in the release response process and describes the activities necessary for owners and operators to comply with the State UST regulations for release response.

### **5.3 The Release Response Process**

#### **5.3.1 Introduction**

As mentioned above, the DOH has divided the State UST release response requirements into three segments. These segments are the: (1) immediate response actions, (2) initial release response, and (3) and long-term release response actions.

**Immediate response actions** include activities which must be taken within the first 24 hours and 7 days after the discovery of a release to identify the type and location of the release and any safety hazards associated with the release.

**Initial release response actions** consist of initial response and abatement actions that must be taken within a relatively short time frame (within 90 days) in order to prevent further releases into the environment, to minimize the potential impact that a release may have on human health, the environment, public safety, and to assess the extent of contamination caused by the release, and complete cleanup of the release, if possible.

Owners and operators must submit an Initial Release Response Report to DOH within 90 days of confirming a release which fully describes all actions taken within the 90-day period. If a release was discovered while performing UST closure, the Initial

Release Response Report should include information on the UST closure as appropriate.

**Long-term release response actions** are those response actions that take more than 90 days for completion. Long-term response actions after 90 days include activities necessary to effectively contain and control the release, investigate the nature and extent of the release, and remediate the release to enable a determination that residual contamination at a site is protective of human health and the environment.

For sites where residual contamination (after treatment) of the soil and groundwater is at concentrations protective of human health and the environment, no further action is required, provided that all contaminated materials have been properly stored, transported, treated, and/or disposed of. No further action indicates the release response process has been completed.

### **5.3.2 Immediate Release Response**

The State UST regulations require owners and operators to take immediate actions in response to releases from their USTs. Immediate response actions include activities which must be taken within the first 24 hours after the discovery of a release. Emphasis is placed on the time-critical nature of taking these actions.

When a release from a UST is confirmed, owners and operators must immediately perform the following response steps within 24 hours:

1. Report the release to DOH by telephone at (808) 586-4226 or fax at (808) 586-7509. Owners and operators should provide information regarding facility location, DOH facility identification number, source and nature of release, and immediate hazards. Owners and operators should also inform DOH of all immediate actions taken or planned to be taken in response to the release.



2. Identify and mitigate fire, explosion, and vapor hazards:
  - Check nearby utility conduits, basements, buildings, and vaults with an explosimeter;
  - Evacuate and ventilate affected areas as necessary;
  - Eliminate sources of spark or ignition from affected areas; and
  - Control public accessibility to the affected areas.
3. Take immediate action to prevent any further release of the regulated substance into the environment:
  - Pump out all remaining product in leaking tank(s) and piping;
  - Control and contain any visible accumulations of product on surface water or in excavations, utility conduits, basements, vaults, etc; and
  - Initiate free product removal as necessary.
4. Take necessary action to minimize the spread of contamination.
5. Provide alternative drinking water supplies to affected populations, as necessary.
6. If determined appropriate by DOH, post signs around the perimeter of the site to warn of potential hazards.

Within 7 days of release confirmation, owners and operators must submit to DOH written notification confirming the release. This written release notification must include, but not be limited to the following information: source of release, method of discovery and confirmation, estimated quantity of substance released, type of substance released, immediate hazards, release impact, migration pathways, and actions taken. A copy of the Confirmed Release Notification Form (DOH Form CRN 8/92) is provided in Appendix 5-B.

### **5.3.3 Initial Release Response (Actions Within 90 Days)**

Initial release response actions are considered to be those actions that are undertaken in response to the discovery of a release within the first 90 days and may include initial abatement measures and site assessment, initial site characterization, free product removal, initiation of soil and groundwater investigations, and site cleanup. In

addition, current evidence of financial responsibility must be provided to DOH within 30 days of identifying the release. Depending on the nature of the release, response activities can vary widely depending on site-specific considerations. Release response activities for larger releases include the removal of free product from groundwater, proper management of contaminated soil and other wastes generated (solids and liquids), and the performance of soil and ground-water investigations to assess the full extent of contamination at a site. These more extensive releases will likely require more than 90 days to complete the necessary response actions. Nevertheless, the actions taken within the first 90 days must be reported to DOH in the Initial Release Response Report. A recommended format for an Initial Release Response Report is provided in Appendix 5-C. For smaller releases, the contamination is often more manageable and controllable to the extent that response actions can be completed within the first 90 days. If a release was confirmed by failure of a tank tightness test, information pertinent to the test should also be included in the report of actions taken within the first 90 days of discovery of the release. Similarly, description of activities for releases confirmed by site assessments performed during UST closures should also be included in the 90 day release response report.

The following are descriptions of the actions typically performed during the initial release response phase.

#### **5.3.3.1 Demonstration of Financial Responsibility**

The State UST regulations require that owners and operators must submit to the DOH the appropriate information to document evidence of current financial responsibility within **30 days** after the identification of a release from an UST or tank system.

Owners and operators should refer to HAR 11-281-111(b) for a description of the type of information that should be submitted.

### 5.3.3.2 Initial Abatement Measures and Site Assessment

After responding to any emergency or explosion hazards posed by the UST release, owners and operators must continue to mitigate any safety threats, to remove free product, to remove or remediate contaminated soil or groundwater, to confirm the source(s) of the release, and to determine the nature, magnitude, and extent of contamination.

The following initial abatement measures must be undertaken:

1. Continue to remove as much of the regulated substance from the UST or tank system as is necessary to prevent further release to the environment.
2. Visually inspect the site and vicinity to identify the potential source(s) of the release, to identify obvious potential migration pathways, to identify potential threats of exposure, and to observe any aboveground releases or exposed belowground releases. Prevent further migration of the released substance in to surrounding soils and groundwater.
3. Continue to monitor and mitigate any additional fire and safety hazards posed by vapors or free product that have migrated from the UST excavation zone and entered into subsurface structures (such as sewers, utility conduits, buildings, or basements).
4. Remedy hazards posed by contaminated soils that have been excavated or exposed as a result of release confirmation, initial response, investigation, abatement, or cleanup activities.
5. Remove or remediate contaminated soil to the extent necessary to prevent the spread of free product, as described in Sections 5.3.3.3 and 5.4.2.3.1 below.
6. In cases where the presence of free product has not yet been confirmed, investigate to determine the possible presence of free product, and begin free product removal in accordance with the free product removal requirements listed below (see Section 5.3.3.3).
7. Conduct an assessment of the release by measuring for the presence of the release where contamination is most likely to be present at the UST or tank system unless previously determined by UST site assessment requirements under HAR 11-281-63(b) or 11-281-83.

8. If any of the remedies used for compliance with this section include treatment or disposal of contaminated soils, owners or operators must comply with all applicable local, state and federal requirements.
9. If determined appropriate by DOH, post signs around the perimeter of the site to warn of potential hazards.

Upon completion of the initial abatement measures, an evaluation may be performed to determine if the site is adequately cleaned up to meet DOH's recommended cleanup criteria. Otherwise, additional release response actions will be necessary before the cleanup is completed.

#### **5.3.3.3 Removal of Free Product**

At sites where the investigation indicates the presence of free product, owners and operators must immediately take actions to remove free product to the maximum extent practicable, and as soon as practicable, but no later than 90 days following confirmation of a release or sooner if directed by DOH. In meeting this requirement, owners and operators must:

1. Conduct free product removal in a manner that minimizes the spread of contamination into previously uncontaminated zones;
2. Use abatement of free product migration as a minimum objective for the design of the free product removal system;
3. Handle any flammable products in a safe and competent manner to prevent fires and explosions; and
4. Include information on all actions taken to remove free product in an Initial Release Response Report, and submit the report to DOH within 90 days of release confirmation. Included in this report must be the information required at HAR 11-281-76(a)(4). If free product removal is conducted beyond the 90-day period, also include a description of additional free product removal activities in the Quarterly Release Response Report.

#### **5.3.3.4 Initial Site Characterization**

In order to assess the potential impact of the release on human health and the environment, owners and operators should collect, at a minimum, the following information and submit it to DOH as part of the initial release response report within 90 days of release confirmation:

1. Data on the nature and estimated quantity of the release;
2. Data from available sources and/or site investigations concerning the following factors: surrounding populations, water quality, use and approximate locations of wells potentially affected by the release, subsurface soil conditions, locations of subsurface sewers, climatological data, and land use;
3. Results of the aforementioned site assessment;
4. Results of the free product investigations to determine the need for free product removal;
5. Any other information, as appropriate, which may relate to the impact of the release on human health and the environment.

#### **5.3.3.5 Initial Soil and Groundwater Investigation**

In performing a site soil and groundwater investigation, the owner and operator and their consultant/contractor must measure for the presence of a release where contamination is most likely to be present at the UST site. In selecting sample types, sample locations, and measurement methods, the owner and operator and consultant/contractor must consider the nature of the stored substance, the type of backfill, depth and flow direction of groundwater, and other appropriate factors for identifying the presence and source of the release.

The chemical composition and formulation of petroleum differ greatly among the various types of petroleum products. Therefore, the list of compounds in the cleanup criteria is different for gasoline, diesel, heavy oil, and used or waste oil. At sites where there are multiple releases of different types of petroleum products from USTs, the owner and operator and their consultant and contractor should sample and analyze

for the applicable petroleum compounds. Finally, because used or waste oil is often a mixture of all types of oils and solvents, the cleanup criteria of constituents for used or waste oils is the most extensive. Refer to Table 7.2 for the constituents in soil and groundwater to be assessed according to the types of petroleum products released.

All soil and groundwater assessment activities should be adequately documented and information on these actions detailed in the appropriate sections of the Initial Release Response Report.

#### **5.3.3.6 Site Cleanup**

Owners and operators are required by the State UST regulations to begin cleanup of their site in an expeditious manner. All remediation activities must be performed in a manner that is protective of human health and the environment. In cases where abatement actions are taken to remediate contaminated soil and groundwater during the first 90-day period, a detailed description of such activities should be included using the appropriate sections of the Initial Release Response Report. As described in Section 5.3.4.4, certain releases will require that Corrective Action Plans be prepared, submitted to and approved by the DOH.

In cases where the site investigation indicates that the contaminant levels in the soil and groundwater do not present an unacceptable risk to human health or the environment (and all contaminated soil, water, free product, or other wastes have been properly managed, remediated and disposed of), then no further action is required for this release episode. Otherwise, owners and operators must continue taking response actions beyond the 90-day period and submit additional reports of their actions.

#### **5.3.3.7 Demonstration of Protectiveness**

Necessary final cleanup actions taken in the first 90 days to enable owners and operators to demonstrate that residual contamination is protective of human health and the environment include the following four options (see Section 5.4 for a detailed discussion of these cleanup options). The options are: (1) cleaning up contaminants to DOH recommended Tier 1 action levels for soil and groundwater, (2) for certain sites, the Tier 1 soil action levels may be overly stringent, in which case a Tier 2 site-specific evaluation may be performed to demonstrate residual soil contamination does not present a threat to human health or the environment (3) development of alternative cleanup levels through preparation of a Tier 3 risk assessment, and (4) controlling the residual contaminants by exposure prevention management (while protective, this is a temporary, non-permanent remedy). The cleanup option selected for demonstration of protectiveness must be described in compliance with the reporting requirements of Section 5.6 regardless of whether it is in an Initial Release Response Report or a Quarterly Release Response Report. Depending on site-specific conditions, it may take longer than 90 days before a demonstration of protectiveness can be made.

#### **5.3.3.8 Proper Waste Management**

While undertaking release response actions, owners and operators and their consultants/contractors must properly transport, remediate, store, and dispose of all wastes that may be generated as a result of their actions. All actions taken in the first 90 days to manage, remediate and/or dispose of generated wastes must be adequately detailed in the appropriate sections of the Initial Release Response Report. For more information on waste management, please see Section 6 of this TGM.

#### **5.3.3.9 Public Notice of Confirmed Releases**

As required by the State UST regulations at HAR 11-281-78.1, all confirmed releases require notification by the owner and operator of the public directly affected by a

release and proposed response to the release. Notification must be within 90 days of confirmation.

Members of the public directly affected by the release include: persons who own, hold a lease for, or have easements at any property on which the regulated substance released from the UST was discovered; and other persons as identified by the director.

The owner or operator must notify by letter those members of the public affected by the release and include at a minimum the following information:

1. Facility name and address of the UST or UST system;
2. Statement that a release of regulated substance has been confirmed at the UST or UST system;
3. Name of a contact person at DOH; and
4. Reference to an attached factsheet.

The factsheet in item number 4 above shall contain at a minimum the following information:

1. Facility name and address of the UST or UST system;
2. Name and address of the owner and operator of the UST or UST system;
3. Date of the confirmed release;
4. Nature and extent of the confirmed release;
5. Summary of measures taken to assess the release and extent of contamination; and
6. Summary of the proposed response to the release.

Appendix 5-D contains an example of a public notification letter and a fact sheet.

The State UST regulations require that the factsheet be updated on a quarterly basis and sent to all members of the public directly affected by the release. If additional members of the public directly affected by the release are identified in the course of release response activities, then the owner and operator shall provide those persons with all previous and future letters and factsheets.



The owner and operator will include in the Initial Release Response Report and any subsequent quarterly reports, copies of the notification letter, factsheets distributed to the affected members of the public and a list of members of the public directly affected by the release and to whom the letter was sent.

#### **5.3.4 Long Term Release Response (Actions Greater than 90 Days)**

Long term release response are those actions which require greater than 90 days to complete from the discovery of a release. Long term release response actions include such activities as continued free product removal, continued removal or remediation of petroleum-contaminated soil, additional soil and groundwater investigations, and continued site cleanup. Figure 5.1 provides a general overview of the actions that are required to be taken, as appropriate, during the "Long Term Response Actions" segment of the release response protocol. Owners and operators who continue to take release response actions at their site beyond 90 days from the discovery of the release must provide information which describes the activities undertaken during this time period in Quarterly Release Response Reports. The Quarterly Release Response Reports should be submitted to DOH beginning 180 days from the confirmation of the release. DOH recommends that owners and operators and their consultants and contractors use the Quarterly Release Response Report format provided in Appendix 5-E for this purpose.

Ideally, the information contained in the Initial Release Response Report should provide an adequate assessment of the full extent of contamination to soil and groundwater and the results of all cleanup actions so that decisions can be made as to which cleanup option, or combination of cleanup options, should be used in order to demonstrate that residual contamination is protective of human health and the environment. For some release cases, owners and operators and their consultants and contractors may be able to demonstrate that they have adequately characterized and cleaned up their site to meet one of DOH's four cleanup options (see Table 5.1 and Section 5.4) and have properly treated and disposed of all contaminated soil and

groundwater and other generated wastes within 90 days from the discovery of the release. For these particular release sites and depending on the remedial action selected, owners and operators may not be required to take further action in response to the UST release but must submit the Initial Release Response Report to verify that one of the DOH's four cleanup options have been met at the site.

However, for most larger release sites with more extensive contamination to soil and groundwater, owners and operators may not be able to complete their release investigations and site cleanups within 90 days from the discovery of the release. In these instances, owners and operators must submit additional reports to DOH depending on the cleanup option, or combination of cleanup options, that is chosen for the site. These additional reports should demonstrate that residual contamination to soil and groundwater is protective of human health and the environment. The reporting requirements for the four cleanup options are discussed in more detail in Subsection 5.4 and 5.6. A schedule for completion of cleanup shall be submitted no later than the fourth quarter (360 days) after confirmation of the release.

#### **5.3.4.1 Continued Free Product Removal**

Owners and operators must continue to remove free product from the water table in cases where free product continues to persist at a site beyond 90 days from the discovery of a release. In addition, if free product is discovered at any time, owners and operators must immediately initiate free product removal actions. In either case, owners and operators should remove free product on the water table to the extent practicable at their sites. Owners and operators should gather information on their free product removal efforts and include this information in the appropriate sections of the Quarterly Release Response Report.

#### **5.3.4.2 Continued Soil and GroundWater Investigations**

In many cases, it will not be possible to fully define the nature, magnitude, and extent of contamination to soil and groundwater at an UST site within 90 days from the discovery of the release. Furthermore, site information pertaining to likely paths of contaminant migration, or potential human and non-human exposure pathways, may not be sufficient enough to make a firm decision on which cleanup option, or combination of cleanup options, to use at the site to demonstrate protectiveness.

In cases where investigations are not completed in 90 days, the owner and operator must continue to investigate soil and ground-water contamination to characterize the contamination. Generally, these additional soil and ground-water investigations are often necessary when:

1. There is evidence that contaminated soils may be in contact with groundwater;
2. A complex mixture of petroleum and non-petroleum contaminants is present;
3. Free product must be removed;
4. There is evidence that water supply wells (i.e., drinking, or agricultural wells) have been affected by the release;
5. The potential effects of contaminated soil or groundwater on nearby surface water and groundwater resources (existing or potential future water supplies) are not well understood; or
6. Surrounding populations (human and non-human) are potentially at risk;
7. The hydrology at the UST site is complex.

In conducting soil and groundwater investigations, owners and operators should use acceptable EPA methods and practices in procuring soil borings, installing and developing monitoring wells, and sampling and analysis. Owners and operators and their consultants/contractors should refer to Section 7 for more information on DOH's recommended procedures for soil and groundwater sampling and analysis at UST release sites. Owners and operators should describe the details and findings of these

additional investigations in the appropriate sections of the Quarterly Release Response Report(s).

#### **5.3.4.3 Continued Site Cleanup**

Owners and operators and their consultants and contractors should continue to identify and remove or remediate any contaminated soil and/or groundwater which may be present at the site beyond the 90-day period from the discovery of the release. Cleanup of contaminated soil and/or groundwater must be continued until it can be demonstrated that any remaining residual contamination at the site would not present an unacceptable risk to human health or the environment (see Section 5.4 on Options Available to Demonstrate that Residual Contamination is protective of Human Health and the Environment). All excavated soil must be properly managed whether it is onsite or offsite (see Section 6 on Waste Management). Information describing all soil management and remediation efforts, and the results of such efforts, should be included in the appropriate sections of the Quarterly Release Response Report.

#### **5.3.4.4 Corrective Action Plans**

The State UST regulations state that the DOH may require the submittal of a Corrective Action Plan (CAP) for responding to a release if one or more of the following criteria are met:

1. Actual or probable release to groundwater which is a drinking water supply;
2. Actual or probable release to surface water which is a drinking water supply;
3. Actual or probable release to air that poses a threat to public health;
4. Actual or probable release to and extensive contamination of soil that poses a direct contact hazard due to uncontrolled access;
5. Actual or probable existence of uncontrolled regulated substances that pose a direct contact hazard due to uncontrolled access;

6. Actual or probable adverse impact to natural resources;
7. Actual or probable imminent danger of fire or explosion; or
8. A determination by the director that a release poses a substantial endangerment to public health or welfare, the environment, or natural resources.

The above are conditions that have a significant potential to adversely affect human health or the environment if not promptly controlled and effectively remediated. The DOH recognizes the importance of releases that meet one or more of the above conditions, and consequently, is taking a more immediate and direct involvement in the approval of health protective remedies considered for these sites.

If the DOH finds that one or more of the above criteria have been met, DOH will notify the owner or operator that a written CAP is required for submittal to the DOH for its review and approval within 30 days unless an extension of time is granted. The DOH may require changes to the CAP as part of its review or at any time during the ongoing implementation of the CAP. Upon DOH's approval of the CAP, owners and operators must implement the approved plan including any modifications required by DOH. Owners and operators who have been requested by DOH to submit a CAP, but believe expeditious implementation of correction action is required at their site and desire to start cleanup prior to DOH approval of their CAP, may do so provided that they:

1. Notify the department of their intention to begin cleanup;
2. Ensure that cleanup measures undertaken are consistent with DOH site cleanup criteria;
3. Comply with any conditions imposed by the DOH; and
4. Include the self-initiated cleanup measures in the corrective action plan.

In the review of the written CAP, DOH will consider the following information to ensure that the implementation of the CAP will adequately protect human health and the environment:

1. The physical and chemical characteristics of the regulated substance, including its toxicity, persistence, and potential for migration;
2. The hydrogeologic characteristics of the facility and the surrounding area;
3. The proximity, quality, and current and future uses of nearby surface water and groundwater;
4. The potential effects of residual contamination on nearby surface water and groundwater;
5. An exposure assessment; and,
6. Any information assembled in compliance with Section 5 of the TGM.

The DOH will approve written corrective action plans only after owners and operators demonstrate to DOH that their CAP will be safe and adequately protect human health and the environment. An outline of the information which should be included in the CAP is provided in Appendix 5-F. Once approved by DOH and implemented, owners and operators must monitor, evaluate, and report quarterly on the success of the CAP. These quarterly (90 day) reports may be included in Quarterly Release Response Reports described in Section 5.3.4 or submitted as stand alone quarterly CAP reports.

The public notice procedures described in the following Section 5.3.4.5 apply to all submitted CAPs.

#### **5.3.4.5 Public Participation for Corrective Action Plans**

The State UST regulations at HAR 11-281-80 require that public participation activities be conducted for UST release sites requiring CAPs or where a previously approved CAP has been found by DOH to be ineffective in achieving its intended cleanup goals.

Public participation activities include:

1. The notification of those individuals directly affected by the release as well as the general public with information on the release and the proposed release activity;
2. If found appropriate by DOH or sufficient public interest is expressed, then a public meeting shall be conducted to provide information and receive comment on the CAP; and
3. The information and materials on the release, proposed CAP, and DOH's tentative decision shall be made available to the public for inspection upon request.

The costs for the above described public participation activities will be borne by the owner and operator.

Members of the public directly affected by the release include those individuals defined in HAR 11-281-78.1(a) and described in Section 5.3.3.9 of this TGM as well as all other members of the general public.

Public notice to those individuals defined at HAR 11-281-78.1(a) will be a letter from DOH providing at a minimum the following information:

1. The facility name and address of the UST or UST system location;
2. the name and address of the owner and operator of the UST or UST system;
3. summary of the release information and the proposed or previously approved corrective action plan;
4. DOH's tentative decision concerning the proposed CAP or concerning the termination of the previously approved CAP;
5. an announcement that an informational meeting will be held if there is sufficient public interest;

6. a request for comments on the CAP and the DOH's tentative decision;  
and,

7. the availability of information on the release and DOH's tentative decision.

Notification to all other members of the general public should occur through notice in a local newspaper and contain at least the information described in the above paragraph.

## **5.4 Options Available to Demonstrate that Residual Contamination is Protective of Human Health and the Environment**

### **5.4.1 General Discussion**

Owners and operators are required to respond to releases from their USTs in accordance with HAR 11-281, Subchapter 7. In particular, the State UST regulations specifically require owners and operators to clean up contaminated soil and groundwater to levels that are protective of human health and the environment. This protectiveness standard applies to every UST release site.

To assist owners and operators in demonstrating that their sites meet this minimum protectiveness standard, DOH is setting forth four cleanup options from which owners and operators may choose. The four cleanup options available include the following:

- |           |   |
|-----------|---|
| Option 1: | Compliance with DOH's Tier 1 Action Levels for soil and groundwater                                 |
| Option 2: | Compliance with Tier 2 Site Specific Soil Action Levels   |
| Option 3: | Demonstrate acceptability of residual contamination through performance of a Tier 3 Risk Assessment |
| Option 4: | Exposure Prevention Management  |



This subsection provides a discussion on each of the four available cleanup options. In addition, this subsection identifies reports that should be submitted to DOH for each of the cleanup options. Furthermore, several reporting formats are recommended for owners and operators and their consultants/contractors to use when submitting information for their cleanup activities.

In some release cases, owners and operators may have cleaned up their sites and submitted information in their Initial Release Response Reports that indicate that soil and groundwater at their sites meet DOH's Tier 1 action levels or Tier 2 soil action levels. In these cases, no further cleanup action is required of owners and operators.

However, for many extensive release cases, owners and operators will continue their release response activities beyond 90 days from the discovery of the release. For these cases, DOH is requesting that owners and operators submit additional information which describes their progress in cleaning up their sites every 90 days thereafter (i.e., one progress report every quarter after the 90-day period from the discovery of the release) until they can demonstrate that residual contaminant levels at their sites are protective by using one or more of the available cleanup options. Progress reports should be submitted to DOH regardless of which cleanup option, or combination of cleanup options, is selected.

As such, DOH is requesting that owners and operators submit information on their cleanup actions in their Quarterly Release Response Report. This report is intended to provide DOH with timely and periodic information on the progress being made toward cleaning up a site. The owner and operator should continue to provide progress reports to DOH on a quarterly basis until cleanup of the site is completed using one or more of the cleanup options.

Once the owner and operator demonstrate compliance with one or more of the cleanup options for a site, then the owner and operator can submit a final Quarterly

Release Response Report to DOH which includes the necessary information to demonstrate compliance with one or more of following cleanup options:

1. For Option 1, a demonstration that contaminant concentrations in soil and/or groundwater, as determined by an acceptable site characterization effort, are less than DOH Tier 1 action levels following the guidelines in the HODOH RBCA document;
2. For Option 2, a demonstration that soil contaminant concentrations, as determined by an acceptable site characterization effort, are less than site specific Tier 2 action levels developed following the guidelines in the HODOH RBCA document;
3. For Option 3, which is the Tier 3 risk assessment component of HODOH RBCA document, the use of sophisticated risk assessment analyses is allowed. This may include the use of more complex statistical analysis and contaminant and fate and transport analyses, direct and indirect exposure models and exposure pathway evaluations. Tier 3 evaluations usually involve collection of additional site information and completion of more extensive modeling efforts than is required for either a Tier 1 or 2 evaluation.
4. For Option 4, both an exposure pathway assessment report that demonstrates that no exposure pathways exist, and an exposure prevention management plan that ensures protectiveness by maintaining the absence of exposure pathways must be prepared.

#### **5.4.2 Option 1: DOH's Tier 1 Action Levels for Soil and Groundwater**

##### **5.4.2.1 Introduction**

DOH realizes that cleaning up soil and groundwater at a site can be very time-consuming and extremely expensive. This is especially true if each owner and operator were required to perform a risk assessment to establish site-specific cleanup levels for soil and groundwater which are protective of human health and the environment. The first edition of the TGM provided recommended interim cleanup levels for soil and groundwater. These cleanup levels were based upon such factors as: release location with respect to the UIC line, physical and chemical properties of

the contaminants, and the effect of direct exposure to human and ecological receptors.

With the release of the DOH RBCA document, revised soil and groundwater action levels were issued and are referred to as "Tier 1 action levels." These revised criteria replace and take precedence over the cleanup criteria presented in the first edition TGM. Tier 1 groundwater action levels are applicable to a given site based upon the following two general site characteristics:

1. Utility (drinking water or non-drinking water) of groundwater impacted or potentially impacted; and
2. Annual rainfall at the site (less than or greater than 200 cm/yr).

Groundwater action levels for sources of drinking water are based on State and/or Federal maximum contaminant levels (MCLs) for drinking water. Recommended action levels for groundwater that is not a source of drinking water are taken from the state surface water standards unless otherwise noted (Hawaii Administrative Rules Title 11, Chapter 54).

It should be noted that the Tier 1 groundwater action levels are fixed and cannot be made more "site-specific ." However, as discussed in Section 5.4.4 of this document, exceeding groundwater action levels at a site does not necessarily require that immediate, engineered remedial actions are necessary.

Tier 1 soil action levels (SALs) were generated to address three concerns at release sites:

1. Potential adverse impact on groundwater due to leaching of residual contamination from impacted soil;
2. Potential adverse impact on groundwater due to remobilization of free-phase product in impacted soils; and
3. Potential threats to human health due to direct exposure to impacted soil.

The Tier 1 SALs are considered very conservative and adequate for any impacted site unless otherwise directed by DOH. Tier 1 action levels for soil and groundwater are presented in Table 5-2.

One of the cleanup options available to owners and operators is to cleanup soil and groundwater at the site to Tier 1 action levels which have been determined by DOH to be protective of human health and the environment for all sites in Hawaii. Of the four available cleanup options, this option is the simplest and most direct.

In cases where this criteria is impractical, then Tier 2, Tier 3, or the Exposure Prevention Management options are available to owners and operators. Readers are referred to Chapter 1 of the DOH *Risk-Based Corrective Action and Decision Making at Sites with Contaminated Soil and Groundwater Volume I* document dated June 1996, for a thorough explanation of the development and use of the Tier 1 action levels.

#### **5.4.2.2 Rationale for Tier 1 Action Levels for Groundwater**

##### **5.4.2.2.1 Groundwater Utility**

DOH's approach to determining Tier 1 actions levels for groundwater is keyed in part to the Underground Injection Control Line (UIC line) and the "Aquifer Identification and Classification" technical report series published for each island by the Water Resources Research Center (WRRC) at the University of Hawaii - Manoa (see references). The UIC line and WRRC reports are used as a determinant to the level of protectiveness that is reflected in the criteria. Generally, the UIC line was established by DOH to regulate the injection of wastewaters into the ground in order to protect Hawaii's underground drinking waters from pollution. In accordance with the UIC guidelines, aquifer systems mauka (inland) of the UIC line are by default considered to be current or potential sources of drinking water. Aquifer systems makai (oceanward) of the UIC

TABLE 5-2a. Tier 1 Action Levels for soil and groundwater:  
Rainfall  $\leq$  200cm/year

RAINFALL $\leq$ 200CM/YEAR				
Contaminant	DRINKING WATER SOURCE THREATENED		DRINKING WATER SOURCE NOT THREATENED	
	Groundwater (mg/l)	Soil (mg/kg):	Groundwater (mg/l)	Soil (mg/kg):
Benzene	0.005	0.05	1.7	1.7
Toluene	1.0	16	2.1	34
Ethylbenzene	(0.14)	0.50	0.14	0.50
Xylene	10	23	[10]	23
MTBE	0.020	0.005	202	20
Benzo(a)pyrene	0.0002	1.0de	[0.0002]	1.0de
Acenaphthene	(0.32)	18sat	0.32	18sat
Fluoranthene	(0.013)	11sat	0.013	11sat
Naphthalene	0.24	41sat	0.77	41sat
PCE	0.005	0.29	0.145	5.0de
1,1 DCE	0.046	0.47de	3.9	0.47de
Vinyl Chloride	0.002	0.18de	[0.002]	0.18de
TCE	0.005	0.01	0.70	1.5
1,1,1 TCA	0.20	0.10	6.0	3.0
PCBs (all)	0.0005	1de	0.002	1de
Lead (total)	(0.0056)	400de	0.0056	400de
Cadmium (total)	0.005	38de	0.009	38de
TPH-residual fuels	NS	5,000	NS	5,000
TPH-middle distillates	NS	5,000	NS	5,000
TPH-gasolines	NS	2,000	NS	2,000

**TABLE 5-2b. Tier 1 Action Levels for soil and groundwater:  
Rainfall > 200cm/year**

RAINFALL > 200CM/YEAR				
Contaminant	DRINKING WATER SOURCE THREATENED		DRINKING WATER SOURCE NOT THREATENED	
	Groundwater (mg/l)	Soil (mg/kg):	Groundwater (mg/l)	Soil (mg/kg):
Benzene	0.005	0.05	1.7	0.68
Toluene	1.0	2.6	2.1	5.5
Ethylbenzene	(0.14)	0.13	0.14	0.13
Xylene	10	8	[10]	8
MTBE	0.020	0.005	202	20
Benzo(a)pyrene	0.0002	1.0de	[0.0002]	1.0de
Acenaphthene	(0.32)	18sat	0.32	18sat
Fluoranthene	(0.013)	11sat	0.013	11sat
Naphthalene	0.24	41sat	0.77	41sat
PCE	0.005	0.04	0.145	1.1
1,1 DCE	0.046	0.47de	3.9	0.47de
Vinyl Chloride	0.002	0.18de	[0.002]	0.18de
TCE	0.005	0.004	0.70	0.56
1,1,1 TCA	0.20	0.06	6.0	1.9
PCBs (all)	0.0005	1de	0.002	1de
Lead (total)	(0.0056)	400de	0.0056	400de
Cadmium (total)	0.005	38de	0.009	38de
TPH-residual fuels	NS	5,000	NS	5,000
TPH-middle distillates	NS	5,000	NS	5,000
TPH-gasolines	NS	2,000	NS	2,000

**TABLE 5-2a (cont.) Tier 1 Action Levels for soil and groundwater:  
Rainfall  $\leq 200\text{cm/year}$**

RAINFALL $\leq 200\text{CM/YEAR}$				
Contaminant	DRINKING WATER SOURCE THREATENED		DRINKING WATER SOURCE NOT THREATENED	
	Groundwater (mg/l)	Soil (mg/kg):	Groundwater (mg/l)	Soil (mg/kg):
Acetone	0.61	5.8	[0.61]	5.8
Chlorobenzene	0.10	0.08	[0.10]	0.08
Chloroform	0.00016	0.001	9.6	2.8de
4,4 DDD	0.0003	1.8de	0.0006	1.8de
4,4 DDE	0.0002	1.3de	0.014	1.3de
4,4 DDT	0.0002	0.82sat	0.000001	0.82sat
Di-n-octyl phthalate	0.73	31sat	[0.73]	31sat
Ethylene glycol	73,000	18,000sat	[73,000]	18,000sat
Methylene chloride	0.0043	0.003	[0.0043]	0.003
2,3,7,8 TCDD (Dioxin)	4.5E-10	0.000004de	0.000003	0.000004de
Chlordane	0.002	0.38de	0.0043	0.38de
Carbon tetrachloride	0.005	0.15	12	1.9de

**TABLE 5-2b (cont.) Tier 1 Action Levels for soil and groundwater:  
Rainfall > 200cm/year**

RAINFALL > 200CM/YEAR				
Contaminant	DRINKING WATER SOURCE THREATENED		DRINKING WATER SOURCE NOT THREATENED	
	Groundwater (mg/l)	Soil (mg/kg):	Groundwater (mg/l)	Soil (mg/kg):
Acetone	0.61	0.06	[0.61]	0.06
Chlorobenzene	0.10	0.05	[0.10]	0.05
Chloroform	0.00016	0.0001	9.6	2.8de
4,4 DDD	0.0003	1.8de	0.0006	1.8de
4,4 DDE	0.0002	1.3de	0.014	1.3de
4,4 DDT	0.0002	0.82sat	0.000001	0.82sat
Di-n-octyl phthalate	0.73	31sat	[0.73]	31sat
Ethylene glycol	73,000	18,000sat	[73,000]	18,000sat
Methylene chloride	0.0043	0.002	[0.0043]	0.002
2,3,7,8 TCDD (Dioxin)	4.5E-10	0.000004de	0.000003	0.000004de
Chloroane	0.002	0.38de	0.0043	0.38de
Carbon tetrachloride	0.005	0.024	12	1.9de



TABLE 5-2 (cont.). Tier 1 Action Levels for soil and groundwater: Notes

**ANNOTATIONS:**

unmarked criteria: groundwater-protection concerns dominate  
 de: direct-exposure concerns dominate  
 sat: saturation concentration, groundwater-protection concerns dominate  
 (): Same as surface water; surface water standard more stringent than drinkingwater standard.  
 []: Same as drinking water; surface water standards not set.  
 NS: no standard, no drinking water or surface water criteria set.  
 PCE: tetrachloroethylene, DCE: dichloroethylene, TCE: trichloroethylene, TCA: trichloroethane,  
 PCBs: polychlorinated biphenyls, TPH: total petroleum hydrocarbons

**NOTES:**

1. Determination of groundwater utility should be determined based on the DOH policy *Determination of Groundwater Utility at Leaking Underground Storage Tank Sites* (September 13, 1995). (HIDOH, 1995b)
2. TPH criteria as presented in *Reporting, Remediation, and Management of Petroleum-Contaminated Soil* (December, 1995). (HIDOH, 1995d). Gasolines: characterized by a predominance of alkyl benzenes and straight-chain, branched, and cyclo- alkanes and alkenes with carbon ranges of C6 to C12. Middles distillates (e.g., kerosene, diesel fuel, home heating fuel, jet fuel, etc.): characterized by a predominance of straight-chain alkanes and polynuclear aromatic hydrocarbons with carbon ranges of C12 to C24. Residual fuels: characterized by long chain alkanes (carbon range > C24) and less predominant aromatics that include phenathrenes, benzopyrenes, and other poly-nuclear aromatic hydrocarbons.
3. The facility should contact DOH for further guidance when laboratory practical quantification limits exceed the recommended groundwater criteria.
4. Lowermost limit on soil action levels for benzene leachate concerns set at 0.05mg/kg based on field experience rather than adhering to SESOIL results. (See Chapter 1.)
5. Soil action levels set for leachate-impact concerns (SALs not annotated with "sat" or "de") assume depth to groundwater is two meters or less and assume no dilution of leachate in groundwater (i.e., Dilution Attenuation Factor (DAF) = 1. Not applicable to TPH criteria. See Chapter 2 and Table 1 in Appendix F.).
6. Refer to Tier 2 discussion (Chapter 2) for guidance on adjustment of Tier 1 leachate-impact SALs with respect to depth to groundwater from the base of the impacted soil and site-specific DAFs.

**GROUNDWATER-IMPACT MODEL (see text)**

Climate data: Standard rainfall models: 'Āhuimanu Loop station data adjusted to 200cm annual rainfall.

High rainfall models: Honomū Mauka station data adjusted to 400cm annual rainfall.

Geologic model: Sand or very permeable saprolite/soil overlying fractured, porous basalt.

**DIRECT-EXPOSURE MODEL (see text)**

Assumes long-term residential exposure to impacted soil through inhalation, ingestion, and dermal absorption.

line are considered by default to not be current or potential sources of drinking water. Correspondingly, action levels for release sites located mauka of the UIC line are initially set to be protective of drinking water standards. Action levels for release sites located makai of the UIC line are set to be protective of generally less stringent non-drinking water (surface water) standards.

Since establishment of the UIC line, DOH has sponsored additional research regarding the identification, classification, and protection of groundwater resources in Hawaii. The most important outcome of this research to date has been the WRRC *Aquifer Identification and Classification* technical reports. The WRRC reports systematically review aquifer systems throughout each island and, as one element, indicate whether the aquifer system as a whole can or cannot be utilized as a source of drinking water. Because the division of the aquifer system is based largely on geology, the WRRC aquifer classification system reports address many of the problem areas brought about by reliance on only the UIC line to approximate groundwater utility.

Depending upon the LUST facility location, the choice of whether to use the UIC line or WRRC technical reports as a means to determine if an impacted aquifer system is or potentially could be utilized as drinking water source may vary. Owners and operators are referred to the September 19, 1995, Policy Update titled *Determination of Groundwater Utility at Leaking Underground Storage Tank Sites* and the January 5, 1996, Policy Update titled *Addendum to: Determination of Groundwater Utility at Leaking Underground Storage Tank Sites (September 19, 1995) Example Re-assessment of Groundwater Utility and Applicable Soil and Groundwater Action Levels* (located in Appendix 5-G) for assistance in delineation and determining utility of groundwater systems on the islands.

#### **5.4.2.2.2 Groundwater Action Levels**

Action levels for release that threaten sources of drinking water are based primarily on human health concerns. Action levels for releases that threaten non-drinking water sources are based primarily on ecological/aquatic-life concerns. In general, action levels for releases that threaten drinking water are much more stringent than for those that do not.

DOH Tier 1 groundwater action levels for common contaminants of concern at all sites were initially set to meet surface water quality criteria. This is intended to be protective of aquatic ecosystems should contaminated groundwater migrate or otherwise be discharged into a body of surface water. The criteria presented are based on State and Federal acute or, when available, chronic surface water standards. For sites where the groundwater of concern is a current or potential source of drinking water, Tier 1 action levels are adjusted where needed to ensure that State and/or Federal drinking water standards, maximum contaminant levels (MCLs), or alternative drinking water criteria are additionally met. It should be noted that drinking water standards are substituted for surface water standards where the latter have not been established.

#### **5.4.2.3 Rational for Tier 1 Action Levels for Soil**

The Tier 1 soil action levels were generated to address three coinciding concerns at impacted sites:

1. Potential adverse impact on groundwater due to leaching of contamination from impacted soil;
2. Potential adverse impact on groundwater due to remobilization of free-phase product in impacted soils; and
3. Potential threats to human health due to direct exposure to impacted soil.

The Tier 1 soil action levels are considered very conservative and adequate for any impacted site unless otherwise directed by DOH.

The Tier 1 lookup tables presented on Table 5-2 were generated by comparing soil actions levels generated for groundwater leachate impact, contaminant soil saturation, and direct exposure impact. The potential impact of leachate and free-phase product on groundwater was evaluated by use of SESOIL, a vadose-zone, contaminant fate and transport computer application. Direct-exposure concerns were evaluated by a slightly modified use of quantitative, risk-based, deterministic models used by EPA Region IX for development of "Preliminary Remediation Goals (PRGs)". For relatively mobile contaminants (e.g., volatile and semi-volatile organic compounds), soil action levels were generated to address each of the three concerns and then compared. The most stringent of the three action levels generated was then chosen as the action level for the impacted-site scenario. For metals and other comparatively less mobile contaminants, only the direct-exposure pathway was taken into account to generate the soil action level. DOH may require additional TCLP soil analysis for less mobile contaminants on a site-by-site basis.

#### **5.4.2.3.1 Rationale for Tier 1 Action Levels for Total Petroleum Hydrocarbons (TPH) in Soil**

When left in place at a release site, petroleum-contaminated soil can pose potential nuisance problems, concerns regarding offsite migration of residual free product (e.g., via the groundwater), and concerns regarding the future off-site re-use and disposal of the soil. In previous guidance (TGM, August, 1992), DOH recommended that "grossly contaminated" soil be remediated in order to minimize potential exacerbation of the release or potential nuisance problem. Subsequent reporting and management of petroleum-contaminated soil left in place at release sites has, however, have been very inconsistent and DOH received numerous requests for TPH "cleanup" criteria as well as clarification of DOH policy regarding the reporting and management of petroleum-contaminated soil left in place at release sites.

To address this issue, DOH has set soil actions levels for total petroleum hydrocarbons (TPH). For a complete discussion of this subject, the reader should review the DOH Policy Update titled "Reporting, Remediation, and Management of Petroleum-Contaminated Soil," dated January 4, 1996 and included in Appendix 5-G in this document. The TPH action levels given below are intended to serve as the maximum levels of soil TPH contamination that can be left in place at a LUST site regardless of whether constituent-specific soil criteria have been met:

TPH - gasoline	2,000mg/kg
TPH - middle distillates	5,000mg/kg
TPH - residual fuels	5,000mg/kg

In addition, DOH recommends that petroleum-contaminated soils within 50cm (approximately 20 inches) of the ground surface be remediated to address immediate visual and olfactory nuisance concerns. In many industrial areas, however, DOH realizes that this may not be feasible and indeed a large portion of surface releases in such areas may be due to frequent but small quantity leaks (e.g., from vehicles) that are not directly subject to regulation (i.e., release < 25 gallons). In these cases DOH will evaluate the need for TPH-based clean-up guidelines on a site-specific basis.

At LUST sites where petroleum-contaminated soil has been left in place and residual TPH levels are such that DOH may require oversight if future offsite re-use and disposal activities take place, a note stating this will be made in the "no further action" letter submitted to this facility. Perhaps more importantly, the presence of the contaminated soil will be documented in the DOH public record for the site as a direct reference for future development and excavation activities. DOH does not require that the extent of petroleum-contaminated soil left in place at a former LUST site be defined with respect to TPH except on a site-by-site basis. Full delineation of petroleum-contaminated soil with respect to TPH may be particularly necessary at sites where offsite migration of petroleum is suspected and/or at sites that are regarded as especially ecologically sensitive.

Should petroleum-contaminated soil left in place at a release site ever be excavated, it may be re-used on site without oversight by DOH provided that nuisance concerns are addressed and provided that the soil is not disposed of in an ecologically sensitive area (e.g., wetlands, marshes, near surface water bodies, etc.). If petroleum-contaminated soil is excavated and transported off-site, however, proper transport, re-use and/or disposal of the soil should be discussed with the DOH Office of Solid Waste Management (see Section 6 on Waste Management).

After petroleum-contaminated soils which require remediation have been identified, remediation of the soils in the unsaturated zone can be accomplished either by (1) *in situ* remediation methods, or (2) by excavating, removing, and applying *ex situ* methods to remediate the grossly contaminated soil (either onsite or offsite). To minimize the overall transfer of contamination all together (onsite or offsite), DOH encourages the use of remedial methods onsite whenever practicable and appropriate.

### **5.4.3 Option 2: DOH's Tier 2 Action Levels for Soil**

#### **5.4.3.1 Introduction**

In the past, DOH has allowed the use of site-specific risk assessment (Tier 3) as an alternative to use of default, generally conservative, soil and groundwater action levels (Tier 1). The high costs and general lengthy review time associated with formal risk assessments, however, made the use of this option prohibitive at all but the largest release sites or sites where potential remedial costs outweighed risk assessment costs.

In response to this dilemma, DOH refined its tiered approach to site remedial actions to include a conservative but more flexible and cost-efficient method of setting site-specific soil action levels - Tier 2. In Tier 2, a facility is permitted to substitute actual site data into the same models used to generate Tier 1 SALs as well as additional,

DOH approved models and evaluate groundwater-protection and direct-exposure concerns on a controlled, but more site-specific basis.

Owners and operators are encouraged to use the Tier 2 models to address site-specific remediation needs rather than rely on the Tier 1 lookup tables or before undertaking a more costly and time consuming Tier 3 site evaluation. Owners and operators should be aware, however, that re-use and disposal of impacted soil left in place at a site may fall under regulation by the DOH Office of Solid Waste Management should that soil ever be excavated, regardless of whether the soil meets Tier 1, 2, or 3 criteria for ground-water protection and direct-exposure concerns.

Tier 2 SALs can be generated by use of one or more of the four DOH-approved computer models and spreadsheets. These include:

1. SESOIL (General Services Corporation, version 1.07 and later updates) - used to address leachate impact on groundwater and potential mobilization of free product from impacted soil;
2. QUIKSOIL (DOH developed spreadsheet) - used as a quick but simplistic and conservative alternative to SESOIL to address leachate impact on groundwater;
3. DAF (DOH developed spreadsheet) - used to approximate a site-specific dilution attenuation factor (DAF) that reflects the dilution of leachate as it mixes with groundwater. Tier 1 or Tier 2 SALs generated with SESOIL or Tier 2 SALs generated with QUIKSOIL should be multiplied by the site DAF to refine final SALs for groundwater-protection concerns.
4. DETIER2 (DOH developed spreadsheet) - used to evaluate potential impact on human health from direct-exposure to impacted soil.

The abovementioned DOH developed spreadsheets, are provided with the DOH RBCA manual and includes instruction on their use.

#### 5.4.3.2 Rationale for Tier 2 Action Levels for Soil

Tier 2 soil action levels for groundwater-protection must be set to meet the following objectives:

1. Leachate that infiltrates through the vadose zone and recharges any groundwater system must not cause the groundwater to be impacted at concentrations greater than DOH standards for surface water (either marine or freshwater, whichever is more stringent).
2. Leachate that infiltrates through the vadose zone and recharges a groundwater system that is a current or potential source of drinking water, must not lead to a groundwater impact that exceeds either surface water or drinking water standards.
3. Due to the heightened threat of groundwater impact, residual contamination present in the vadose-zone should not exceed Tier 1, theoretical saturation levels for individual contaminants of concern.

In addition to addressing groundwater protection concerns, Tier 2 SALs ultimately applied to a site must also be protective of residential exposure to impacted soils through inhalation, ingestion, and dermal absorption. With the exception of only a few compounds, most notably benzo(a)pyrene and PCBs, direct-exposure soil action levels generated are set to meet a one-in-a-million ( $10^{-6}$ ) cancer risk for carcinogenic contaminants and a hazard quotient of "1" for non-carcinogenic contaminants. The use of alternative direct-exposure objectives and assumptions at a site must be justified and documented in a Tier 3 risk assessment that is submitted to DOH for review and approval.

#### 5.4.4 Option 3: Tier 3 Risk Assessment

Where owners and operators propose to leave contamination in soil above Tier 1 or Tier 2 SALs and/or water above DOH's Tier 1 groundwater action levels and where complete exposure pathways do exist, the levels of the contaminants left in-place must be supported by a site-specific, quantitative Tier 3 risk assessment. The Tier 3 risk assessment must conclusively demonstrate that the levels of the contaminants left in-place at the site are protective of human health and the environment.



Risk assessment is the foundation for decision making in the release response process and for the development of health-based cleanup standards. Risk assessment may be all or part of a cleanup plan for a site. A risk assessment should be comprehensively applied to cleanup decision-making and must contain objective, technically-defensible conclusions. Risk assessment not only applies to the site of the release itself, but also to any off-site locations where contaminated soil and water may be transported for disposal.

Preparation of a Tier 3 risk assessment to develop alternative cleanup levels at a site may involve numerous complex and technical tasks that are both time-consuming and expensive. It is recommended that owners and operators not enter into this process without fully considering all alternatives, including application of alternative types of technologies to meet DOH's recommended action levels. Tier 3 risk assessments should only be prepared by experienced toxicologists, industrial hygienists, or related specialists who are thoroughly familiar with the risk assessment process. Because of the assumptions inherent in the risk assessment process, and the potentially precedent-setting nature of its conclusions, most risk assessments will be critically reviewed by DOH toxicologists. This review may be a lengthy process in itself. The quality and appropriateness of the prepared risk assessment will ultimately depend on the ability to fully characterize residual contaminants at the site and an adequate assessment of potential exposures to the contaminants.

For guidance in the preparation of a Tier 3 risk assessment, readers should refer to "Appendix 5D Guidelines for Tier 3 Human Health Risk Assessments" of the DOH guidance document titled *Technical Guidance Manual for the Implementation of The Hawaii State Contingency Plan*, dated December 1996 (draft 2).

#### **5.4.4.1 Full Characterization of Contaminants**

It is important to obtain analytical data that fulfills the needs of the Tier 3 risk assessment. Some data obtained solely for the purpose of characterizing the site and the extent of contamination at a site may not be sufficient to meet the quantitative informational requirements of the Tier 3 risk assessment. The objective is to quantify the potential adverse effects contaminants have on human health and the environment. Information collected not meeting the quality of data required may ultimately result in an unacceptable risk assessment, or one in need more reliable data. The data quality needed for a quantitative risk assessment is usually quite rigorous.

To address the risk at a site, a complete characterization of all the contaminants present at the site must be performed. Based on what contaminants are present, appropriate indicator chemical constituents are carefully selected, and the rationale for choosing the indicators is provided (i.e., indicator constituents are normally those which are most toxic, most prevalent, most mobile, etc.). The chosen indicator chemicals represent the contaminants of concern at the site and the risk assessment is performed on that basis.

To characterize the contaminants at a site, it is important to collect samples representative of background conditions since the goal of risk assessment is to determine the potential impact of exposures to contaminants which had resulted from a specific event - in this case, a leaking UST. Background sampling is conducted to distinguish contamination from naturally occurring, upgradient, or non-UST release related contamination. Locations for background samples should be in areas at or near a site which are likely to be contaminated from the UST release, but preferably do have the same basic hydrogeological characteristics as the UST-contaminated portion of the site.

A Tier 3 risk assessment is the scientific evaluation of the potential adverse health effects that exposure to released chemicals has on people and the environment. A Tier 3 risk assessment is conducted to determine levels of contamination that can be

left in-place which are protective of human health and the environment. The first part of risk-based decision-making is risk assessment. The four components of every complete risk assessment are:

1. Data Collection and Evaluation;
2. Toxicity Assessment;
3. Exposure Assessment; and
4. Risk Characterization.

The second part of the risk-based decision making is risk management. Risk management integrates the assessed risk with non-risk related factors to render a final decision. Risk management takes into account such factors as appropriate engineering controls, statutory and legal requirements, economics, public opinions, etc.

#### Data Collection and Evaluation

The initial and very basic step of risk assessment is the gathering and evaluation of data relevant to assessing the effects of a release on human health and the environment. This entails hydrogeological data about the site itself and data about the characterization and the extent of chemical contaminants.

#### Toxicity Assessment

The toxicity assessment component of risk assessment consists of two steps - hazard identification and dose-response assessment. Hazard identification involves gathering and evaluating health effects data on the chemical contaminants. One of the major tasks of hazard identification is to weigh the evidence of health effects data and determine whether the data is appropriate or not appropriate for use in the toxicity assessment for a particular release site. Dose-response assessment is the determination of the quantitative relationship between the dose of exposure to a contaminant and the extent of toxic response. There can be many different dose-response relationships for a contaminant because a contaminant can cause different toxic effects under different conditions of exposure. Most health effects data are those derived from animal studies. One of the major dilemmas in using health effects data is the extrapolation of health effects on animals to project health effects on

humans (EPA uses a multi-stage linear model for this purpose with very conservative exposure assumptions for humans).

One of the primary sources of toxicity information is EPA's Integrated Risk Information System (IRIS). IRIS consists of a collection of computer files on individual chemicals which are regularly reviewed and updated as new health effects data becomes available. The chemical files contain information on reference doses, cancer slope factors, health advisories from EPA, and regulatory action summaries. For information on how to access this database call, IRIS User Support at (513) 569-7254, or see the June 2, 1988, Federal Register notice regarding the availability of IRIS.

The objective of the exposure assessment is to define exposure pathways, identify potentially exposed populations, and to measure or estimate the magnitude, duration, and frequency of exposure for each potential receptor. An assessment of current and future exposures should be conducted, and in some cases there may be multiple exposure pathways.

#### Risk Characterization

The risk characterization component involves the integration of the toxicity assessment and exposure assessment components into a quantitative expression of risk to human health and the environment. To the extent possible, major assumptions and uncertainties associated with the risk assessment process should be identified and discussed. Risk characterization cannot be considered complete unless the numerical expression of risk are accompanied with interpretation and qualification of the results. Risk characterization expresses the overall meaning of, and confidence in, the contaminants hazard, exposure, and risk. This last step of the risk assessment is the starting point for risk management considerations.

#### 5.4.4.2 Reporting and Recordkeeping

A Tier 3 assessment is performed to demonstrate that contamination left in-place is protective of human health and the environment, and should be submitted to DOH as part of one of the Quarterly Release Response Report for a site. DOH strongly recommends that owners and operators that rely on a Tier 3 risk assessment for all or part of their cleanup use the format provided in Appendix 5-H as guidance for a complete risk assessment report. However, in certain cases, a site's use or location may warrant more or less stringent review and oversight by DOH. Furthermore, in some higher priority cases, DOH may request submittal of work plans for cleaning up sites using the risk assessment option.

#### 5.4.5 Option 4: Exposure Prevention Management

Accordingly, DOH is offering an additional cleanup option which relies on the recognition of the lack of exposure pathways inherent to a site, or alternatively, recognizes and relies upon construction of man-made barriers (such as asphalt or concrete pavements) to effectively eliminate existing exposure pathways. This option is viewed as a **temporary (non-permanent)** cleanup option since the potential does exist for the evolution of exposure pathways in the event changes in site conditions occur in the future and because barriers to exposure pathways are not permanent.

DOH believes that if owners and operators can demonstrate that no exposure pathways exist at a site or that engineered controls constructed are effective barriers to exposure pathways, then residual contamination can be left in-place with the establishment of proper monitoring and management practices. The monitoring and management of the site conditions will be an ongoing process which is required to maintain the assertion that no exposure pathways exist. Once an exposure pathway has been created by either migration of the contaminants, land use changes, or the failure of engineering controls or barriers that were emplaced, owners and operators should then be prepared for these contingencies by promptly responding in a manner that will mitigate exposure and risk to human and ecological receptors.

#### 5.4.5.1 Selection of Exposure Prevention Management as an Option

Exposure prevention management consists of two components: (1) an exposure prevention monitoring plan, and (2) a contingency plan. While owners and operators are undertaking release response activities at a site and developing plans for the long term remedy, all cleanup options should be carefully considered based on the characteristics of the site, the contaminants released, and future land uses. Owners and operators should be aware that the exposure prevention management option **involves long-term monitoring for exposure as long as residual contamination remains in-place**. The potential for exposure pathways will always exist at a site for the owner and operator who selects this cleanup option.

In planning for this cleanup option, due consideration should be given to the extensive amount of monitoring and management of the site conditions. The nature of monitoring activities depends on the contaminants present, the extent of the contamination, the location of the site relative to potential human and non-human receptors, and the types of engineered controls or barriers.

In the event that an exposure pathway is created and identified through exposure prevention monitoring, the contingency plan should be activated in response to the potential exposure. The contingency plan should be developed to address all foreseeable exposure contingencies at the site. For any contingencies, the owner and operator can proceed to either clean up the residual contamination to DOH's Tier 1 or Tier 2 action levels or prepare a Tier 3 risk assessment to support alternative cleanup levels that are protective of human health and the environment. Alternatively, they can also continue with the exposure prevention management option and effectively eliminate the newly created exposure pathway by implementing additional engineering controls or restoring barriers that had failed or were breached. The monitoring and management of site conditions are then reinstated, including any necessary modifications to the monitoring plan due to any changes in conditions at the site.

#### 5.4.5.2 Reporting and Recordkeeping Requirements

To demonstrate that no exposure pathways exist at a site, an Exposure Pathway Assessment Report should be submitted to DOH. A recommended format for an Exposure Pathway Assessment Report is provided in Appendix 5-I. DOH will review and evaluate these reports for completeness and any assumptions made. An Exposure Prevention Management Plan is also developed and submitted to DOH. The Exposure Prevention Management Plan for the site includes two parts: a plan for monitoring site conditions for the development of exposure pathways in the future and a contingency plan for actions to be taken when an exposure pathway is identified. A recommended format for an Exposure Prevention Management Plan is provided in Appendix 5-J. Recordkeeping and reporting schedules to DOH are determined on a site-by-site basis. DOH is also likely to review and evaluate Exposure Prevention Management Plans for adequacy of exposure prevention monitoring and contingency plans. When an exposure pathway is discovered, the contingency plan should be promptly implemented; a report describing the nature of the discovered exposure pathway and what actions were taken to mitigate the exposure pathway should be prepared and submitted to DOH. Finally, in certain cases, a site's location with respect to sensitive human and non-human receptors may warrant more stringent oversight and review by DOH. In addition, for some higher priority cases, DOH may request submittals of work plans for sites using the exposure prevention management option.

#### 5.4.6 Criteria for No Further Action at LUST Sites

The final goal for the owner or operator of an UST which has experienced a release of regulated substances, and is therefore subject to the requirements of HAR 11-281, Subchapter 7 Release Response, is to receive a finding from DOH that **no further action** (NFA) needs to be taken in response to the release. To assist owners and operators in achieving this goal, a clear understanding of DOH's criteria for an NFA determination is important. In order for DOH to make a determination of no further action, one of the following three conditions should be met:

1. A release response site investigation, which has adequately determined the nature and extent of contamination, indicates that the release did not result in soil or groundwater contamination in exceedance of DOH Tier 1 actions levels and/or Tier 2 SALs;
2. A release response cleanup action has remediated soil or groundwater contamination to levels which do not exceed DOH Tier 1 action levels for soil or groundwater or Tier 2 SALs for soil;
3. A release with residual contamination, which based upon a Tier 3 risk assessment has been found to not pose an unacceptable risk to human health or the environment, provided **no use restrictions** (i.e., an EPMP) are placed upon the property on which contamination remains.

The DOH UST cleanup policy with respect to protectiveness of human health from contaminants that remain on the property, is that residual contaminants should be at concentrations which are protective of human health based upon an actual or potential unrestricted residential use of the subject property. The DOH will not grant an NFA until this important criteria is met. However, this does not imply that the use of an EPMP is an unacceptable short-term or long-term interim remedy for a specific release. The DOH recognizes that most UST releases occur on property which is not utilized for residential purposes. Instead, these properties are more likely used for commercial or industrial activities (e.g., gasoline retail outlets, military facilities, commercial operations with active fueling and maintenance facilities, etc.). Remediation of all contamination at these sites may not be practicable at this time; nor, due to the lack of existing exposure pathways at the facility, is there a threat posed to human health by residual contamination. As long as these properties remain in industrial/commercial use or other similar non-residential use, the EPMP will be protective of human health. Owners and operators should be aware, however, that DOH will not grant an NFA until one or more of the three conditions described above have been met. Until such time as an NFA is granted, the DOH views a property impacted by a release of regulated substances under HAR 11-281 as an "active leaking underground storage tank site" and subject to oversight by the DOH.



## **5.5 Onsite and Offsite Treatment of Soil, Groundwater, and Site Generated Waste**

### **5.5.1 Treatment Onsite**

Whenever appropriate and practicable, DOH encourages treatment of soil or groundwater onsite. When conducting onsite cleanup, owners and operators must ensure all contaminated soil, groundwater and other waste generated (solids and liquids) are managed in a manner that is protective of human health and the environment (see Section 6 for a more detailed discussion of the proper management of contaminated materials).

### **5.5.2 Treatment at Offsite Treatment Locations**

In some cases (e.g. due to a lack of working space at the UST site, or an immediate need to regain the use of the UST site), owners and operators may elect to transport petroleum-contaminated soil to an offsite location for treatment. Petroleum contaminated soil taken offsite must be transported to a permitted remediation or disposal facility. The transporter of the petroleum-contaminated soil shall notify the DOH Office of Solid Waste Management 48 hours prior to the transport to such facilities. If petroleum-contaminated soil is to be transported to a facility other than a permitted remediation facility, a petroleum-contaminated soil transporter permit from the DOH Office of Solid Waste management is required. A solid waste management permit from the DOH Office of Solid Waste Management will also be required for any off-site remediation or disposal facility to operate. (see Section 6 for a more detailed discussion of the proper management of contaminated materials).

Petroleum contaminated soil is defined as soil that has been contaminated by a release of petroleum to a degree that exceeds the reuse standards set by the DOH Office of Solid Waste Management. Note that these reuse standards may differ from the DOH Tier 1 action levels.

## 5.6 Reporting and Recordkeeping

The types of reports required to be submitted to DOH in response to confirmed releases are presented in Table 5.1. Depending on the nature, extent, and magnitude of the release, the time required to investigate and cleanup a release, and the cleanup option chosen, the number of report submittals required can vary.

For all cases, owners and operators must submit the following reports to DOH: (1) the Confirmed Release Notification (within 24 hours by phone or fax and 7 days using the CRN form), and (2) the Initial Release Response Report (within 90 days of release discovery). For some smaller release cases, owners and operators and their consultants/contractors may be able to completely respond to a release, and remove and remediate contaminated soil and groundwater to meet DOH's generic Tier 1 or site-specific Tier 2 action levels, all within this 90 day period. If this is the case, no further action in response to the release episode is required by owners and operators.

However, for cases which require greater than 90 days to respond, investigate, and cleanup, a Quarterly Release Response Report must also be submitted to DOH within 180 days from release discovery. Additional Quarterly Release Response Reports report submittals may be required depending on which option, or combination of options, owners and operators use to demonstrate that residual contamination is protective of human health and the environment (i.e., Tier 3 risk assessment or Exposure Prevention Management plans).

To facilitate a more complete preparation of a final release response report (either an Initial or Quarterly Release Response Report which propose a site for "no further action") and to help expedite the DOH review and approval of reports, a checklist titled "Hawaii DOH UST Checklist for Final Release Response Reports" is provided as Appendix 5-K. This checklist of pertinent site and remedial information was released as the DOH Policy Update titled *Policy Update for Technical Guidance Manual for Underground Storage Tank Closure and Release Response Checklist for Final Release Response Reports at Leaking Underground Storage Tank Sites* dated

February 23, 1996. The DOH requires that the checklist be completed and submitted with all reports that recommend no further investigative and/or remedial action at leaking underground storage tanks regulated by the DOH Solid and Hazardous Waste Branch. It should be noted that unless otherwise approved or directed by the DOH, reports that do not include all of the information noted in the checklist may be returned as incomplete.

In cases where owners and operators are not responding to their releases in a timely fashion or are not performing their cleanups in a manner which is protective of human health and the environment, DOH may require owners and operators to submit work plans for their release response actions prior to the implementation of site work (see Section 2.1.2 on work plans). Otherwise, work plans for release responses are not normally required to be submitted to DOH, except for those sites of higher environmental priority.

Even though release response reports are submitted to DOH, DOH recommends that owners and operators generate and maintain copies of these reports to demonstrate compliance with the UST requirements, and for liability and legal reasons, these reports should be kept as long as possible. When possible, these records should be maintained at the UST site in the event of a compliance inspection by DOH. In cases where records cannot be maintained at the UST site, records should be maintained at a readily available alternative site such as a central office.